

### 3.0 DESCRIPTION OF THE AFFECTED ENVIRONMENT

Characteristics of the City of Oak Ridge Biosolids, ORR land application sites and WETF wastewaters are available in *Appendix B* of this document.

#### 3.1 REGIONAL DEMOGRAPHY/SOCIOECONOMICS

The first step in providing background for demographic and socioeconomic impact analysis is to define a region of influence for the proposed and alternative actions. All activity related to the alternatives would take place either within the City of Oak Ridge or on the ORR, both of which are located within Anderson and Roane Counties, Tennessee. Knox county is also included because of the substantial financial contribution from the local economy. Although the site of the proposed activities represents a small portion of the entire two-county area, the actions taking place could have repercussions for the entire 3 county area. Therefore, it was assumed that Anderson, Roane and Knox Counties were the appropriate definition for the region of influence (ROI) (see *Appendix C*).

Oak Ridge is located in the east central section of Tennessee, ~32 km (20 miles) west of Knoxville, Tennessee. Oak Ridge includes portions of both Anderson and Roane Counties. The following socioeconomic and demographic data is based upon the most recently available data from the U. S. Department of Commerce Bureau of Economic Analysis. *Appendix C* consists of four tables. *Table C.1* provides an economic profile for Anderson, Roane and Knox counties for 1996-1998, describing personal income, population, per capita incomes, earnings by category, etc. *Table C.2* summarizes the distribution of employment by industry and is inclusive of both full and part-time employment. *Tables C.3* and *C.4* provide summary statistics of economic data for Anderson, Roane and Knox counties.

Key data from *Tables C.1* through *C.4* shows that from 1996 to 2000, the population of Anderson County decreased 0.7%, Roane County increased 0.8% while that of Knox County demonstrated the greatest increase of 1.4%. Per capita personal income rose 10.9% for both Anderson and Roane Counties from 1996 to 1999 while Knox County increased to 14.4% for the same time period.. The employment figures for both full and part-time workers reflected a decline for Anderson (0.4%) and Roane (10.3%) Counties while Knox County displayed an increase of 5.2% during the reference period.

## Environmental Justice

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, signed by President Clinton in February 1994, requires each Federal Agency to formulate a strategy for addressing environmental issues in human health- and environment- related programs, policies, planning and public participation processes, enforcement, and rulemakings. The White House memorandum accompanying the Executive Order directs Federal agencies to "Analyze the environmental effects...of Federal actions, including effects on minority communities and low-income communities, when such analysis is required by NEPA." Pursuant to the Executive Order, environmental justice analyses identify and address any disproportionately high and adverse human health or environmental effects on minority or low-income populations from the proposed actions included in this EA. Adverse health effects may include bodily impairment, infirmity, illness or death. Adverse environmental effects include socioeconomic effects, when those impacts are interrelated to impacts on the natural or physical environment.

Environmental justice guidance defines "minority" as individual(s) who are members of the following population groups: American Indian or Alaskan Native, Asian or Pacific Islander, Black or Hispanic. Minority populations are identified when either the minority population in the affected area is substantially greater than the minority population percentage in the general population in the surrounding area or other appropriate unit of geographical analysis. Low-income populations are identified using statistical poverty thresholds from the Bureau of Census (defined in 1990 as 1989 income less than \$12,674 for a family of four). Minority population and income data at the census tract level are only available from the decennial census. The most recent data available is from 1990.

Biosolids Land Application Program operations are conducted on the ORR near the Y-12 Plant and in remote locations near the newly developed Parcel ED-1 industrial park. The only minority community located in close proximity to active application operations is the Scarboro Community.

The Scarboro Community is located within 2 miles of the active ORR land application sites. The community is located in east Oak Ridge and is bounded to the west by East Fork Ridge and to the east by Pine Ridge. It is a small urban community of approximately 650 individuals that is located approximately 457 m (1,500 ft) northwest of the Y-12 Plant along the ORR boundary. The community occupies an area of approximately 101 ha (250 acres).

Land in the Scarboro Community was cleared and divided into lots ranging in size from approximately 0.1 to 0.2 ha (0.25 to 0.5 acre). The Scarboro Community Center Park and various churches and small businesses are also located in the Scarboro Community.

### **3.2 LAND USE**

The ORR consists of 13,912 ha (34,424 acres) of federally-owned land, most of which is within the corporate limits of the city of Oak Ridge in Anderson and Roane Counties. The predominant land uses on the ORR are environmental research, forest management, industry, agriculture, and wildlife management. Future land uses for the ORR include research facilities, environmental research areas, environmental partnership area, waste management facilities, future initiatives, transportation improvements, education and recreation, and land transfers/lease areas (ORNL, November 2000). Approximately 70% of the ORR is forested. The three major DOE industrial and research facilities occupy approximately the following land areas: the East Tennessee Technology Park (ETTP) Site, 293 ha (725 acres); the Y-12 National Security Complex (Y-12), 332 ha (820 acres); and ORNL, 467 ha (1153 acres). The Oak Ridge National Environmental Research Park consists of approximately 20,000 acres and includes natural and reference areas and environmental research sites. Agricultural lands consist mainly of hay fields that are harvested under commercial contracts.

Major public transportation routes within the ORR include State Highways 95, 58, and 327. Highways 58 and 95 carry inter-city traffic to the east, west, and south of Oak Ridge, and Route 327 provides local access to nearby communities north of the ORR.

### **3.3 ARCHAEOLOGICAL, CULTURAL, AND HISTORICAL RESOURCES**

The ORR has a long history of habitation that began an estimated 10,000 years ago with the first occupation by Native Americans. Most recently, four distinct communities (Elza, Scarboro, Robertsville, and Wheat), with a total of ~1,000 families, existed within the area acquired by the federal government for the Manhattan Project. Forty-six archaeological sites have been identified on the ORR. Seven DOE-owned structures are listed on the National Register of Historic Places; five of these are on the ORR. Additional potential listings include any buildings or structures related to the Manhattan Project. Thirty-one cemeteries are also present on the ORR.

### **3.4 GEOLOGY AND SOILS**

#### **3.4.1 General Geologic Setting**

The ORR lies within the Valley and Ridge Physiographic Province. The Valley and Ridge Province is characterized by steep-sided parallel ridges with broad intervening valleys, generally oriented in a northeast-southwest direction. The ORR lies ~16 km (10 miles) southeast of the Cumberland Mountains and ~113 km (70 miles) northwest of the Blue Ridge Mountains. Elevations on the ORR range from ~230 m (750 ft) above mean sea level (MSL) along the Clinch River to ~385 m (1260 ft) MSL along the highest ridge tops. The Valley and Ridge Province is part of the southern Appalachian fold and thrust belt. The bedrock stratigraphy of the ORR ranges in age from Lower Cambrian to Upper Ordovician and consists primarily of rock units of the Rome Formation, the Conasauga Group, the Knox Group, and the Chickamauga Group.

#### **3.4.2 Site-Specific Geology**

Upper Hayfield #1, Upper Hayfield #2, High Pasture, Rogers and Scarboro Road have all had thorough hydrogeological evaluations and were found to be suitable for the land application of biosolids by TDEC-Division of Solids Waste (TDEC, 1983). Watson Road underwent a full hydrogeological evaluation and was found to be suitable for the land application of biosolids by TDEC-Division of Wastewater (TDEC, 1989). Upper Hayfield #1, Upper Hayfield #2, High Pasture, Rogers and Scarboro Road land application sites are located on the southeast side of Chestnut Ridge. The land surface there is hilly with moderate to steep slopes and total relief of up to 200 feet. Chestnut Ridge is strongly dissected with long, deep drain ways which trend both east-west and north-south.

The direction of surface drainage is quite variable over these sites; however, all the sites drain first into Bethel Valley and subsequently into the Melton Hill Reservoir of the Clinch River about 1 mile to the southeast. The drainage pattern of the area is generally rectangular. Several sinks or depressions occur on these application sites. The application sites referenced predominantly overlie the Knox with just their southeast portions underlain by Chickamauga.

The Cambrian-Ordovician-aged Knox Group is composed primarily of thick-bedded siliceous or cherty dolomite and interbedded dolomitic limestone. These rocks are generally fine to medium-grained and thinly to massively bedded. Chert occurs in the Knox as irregular beds, lenses and nodules.

This group generally underlies broad ridges with fairly gentle slopes to the southeast. Thickness of the Knox Group ranges from 900 m (2469 ft) to 1000 m (2743 ft) (Butz 1984).

Knox dolomite gives rise to dissolution or karst features and sinkholes are common. The Knox Group weathers to form deep residual clay soils, commonly more than 100 feet in thickness. Knox soils resist erosion because of the abundant chert on the surface. The Knox weathers to form generally thick, orange to reddish brown, silty, residual clays with varying amounts of chert fragments and blocks. These soils are mostly Fullerton associations.

The Ordovician-aged Chickamauga Group dominantly comprises limestones sequences with calcareous shales and siltstones. Limestones are generally gray to blue-gray and argillaceous or shaly. Thickness of the Chickamauga can reach 670 m (2208 ft) (Butz 1984). Some beds of relatively “pure” limestone may occur within the Chickamauga in addition to interbedded calcareous shales of varying thickness. Chert occurs sparsely in the Chickamauga limestone. The surfaces of valleys underlain by this group are irregular, with the more silty and cherty layers underlying low ridges and hills. Sinkholes do occur, but are not as numerous nor as large as those found within the Knox Group. Chickamauga soils are thinner than those derived from the Knox and may be brown to reddish-brown to yellowish in color. The soils may contain limestone “float,” particularly in horizons close to the soil-bedrock interface. The Chickamauga soils here are mostly Collegedale and Sequoia associations, but some areas may have Leadvale and Armuchee soil.

Strata in the area generally dip southeastward at about 25 to 35 degrees, although dips may vary considerably in some areas due to small local structures, faults, etc. The Copper Creek fault occurs just southeast of the application sites, its trace extending along the upper northwest side of Haw Ridge whereby the Cambrian Rome formation is thrust over the Ordovician Chickamauga limestone. Intense jointing has occurred in the subject area as attested to by the previously mentioned sinkholes and the strongly dissected land surface, the joints being probably related to the Copper Creek fault. No structures are located on these land application sites.

Groundwater moves mainly within a system of solution enlarged joints in the carbonate bedrock. Groundwater movement is probably generally southeastward toward the Clinch River, but locally such flow may be either to the northeast or southwest to the deep drainages which cut through Haw Ridge and the Copper Creek fault.

Sinks in the area may provide a substantial recharge system for the groundwater reservoir, although some of the sinks appear to be “filling in” with colluvial sediments wherein percolation would be greatly retarded. One spring occurs just to the northwest of the western most application site, High Pasture, however, this spring is up-gradient from the proposed site and is not affected by land application operations.

### **3.5 WATER QUALITY**

Surface water is drained from the ORR by a network of small streams that are tributaries of the Clinch River. Generally, the tributaries of the Clinch River conform to the physiography of the Valley and Ridge Province by paralleling the Clinch for a long distance before crossing a ridge gap to unite with it. The net effect is a trellis pattern that can be seen on a map such as the topographic map of the Oak Ridge area. Each of the three DOE facilities, the ETTP, Y-12, and ORNL, affects a different subbasin of the Clinch River. Drainage from Y-12 enters both Bear Creek and EFPC; ORNL drains into White Oak Creek and several tributaries of the Clinch River; and ETTP drains predominantly into Poplar Creek and Mitchell Branch (DOE 1996). Surface water quality on the ORR is influenced by the geochemistry and soil-water interactions of the subbasins. Water quality is also affected by wastewater discharges and by groundwater transport of contaminants from land disposal of waste. All effluent discharged from ORR facilities to receiving streams must meet various chemical limits that are specified in the NPDES permits for each site (DOE 1996).

The water quality of EFPC is also heavily influenced by activities at Y-12. Discharges from Y-12 at the headwaters and from the Oak Ridge POTW near the middle of the stream's length constitute a large percentage of the stream's mean annual flow. The stream also receives urban and agricultural runoff. Water and sediment in EFPC contain metals, organic chemicals, and radionuclides from past operations at Y-12. These include ammonia, copper, mercury, nitrogen, petroleum-based oils and greases, perchloroethylene, PCBs, and residual chlorine. Recent actions taken at Y-12 to reduce the input of contaminants to EFPC have shown positive results in water quality improvement (DOE 1996). Although treated WETF effluents are currently discharged directly to EFPC, they represent less than 1% of the total flow to the stream and are not considered an important discharge, with regards to flow, to the creek.

The ORR Biosolids Land Application Sites have a number of small tributaries and streams that exist in wooded areas and boundaries of the active sites. These tributaries are protected by a 500 foot buffer zone that prohibits the land application of biosolids material. Surface water monitoring around current biosolids application sites has shown no noticeable degradation of water quality (DOE 1996).

Surface water sampling from Braden Branch above and below the closed McCoy site showed some nitrate enrichment in the stream from the application site (DOE 1996). Analyses for trace metals showed no important elevations, and the highest concentrations of regulated metals were still an order of magnitude or more below drinking water standards (DOE 1996). This sampling was performed following heavy rain showers in January 1988; the McCoy site was closed in September 1986 (DOE 1996).

Stream sampling of Bear Creek, performed during an intense storm event on May 1, 1990, below an active application site (Chestnut Ridge) showed minimal increases in the concentrations of measured parameters (organics, heavy metals, and fecal coliform bacteria). The data suggested that runoff from the application site had minimal ecological or human health effects. Subsequent sampling indicated that effects to the water quality of Bear Creek from the runoff during the storm event were largely restricted to a short-term increase in nutrient loading, biological oxygen demand, and fecal coliform bacteria (DOE 1996). The active land application sites are mostly open hayfields with dense vegetation that were originally selected because of the absence of streams and large ponds. There are no major streams that are adjacent or run through the existing land application sites.

Groundwater occurs on the ORR as localized perched water; as transient, shallow, subsurface stormflow in the unsaturated zone; and as unconfined water tables in the saturated zone. Groundwater quality on the ORR generally is good, with nearly all discharges currently meeting drinking water standards. Nevertheless, groundwater is not used as a source of potable water on the ORR. Because groundwater may provide a pathway for transport of contaminants from past disposal activities on the ORR, monitoring is being performed in greater than 1,400 groundwater monitoring wells to evaluate any current impacts to this resource. Typically, groundwater contamination is most likely to occur from activities in areas of shallow groundwater or in karst areas (DOE 1996).

### **3.6 FLOODPLAINS AND WETLANDS**

Science Applications International Corporation (SAIC) conducted a wetlands survey in the summer and fall of 1996 on a total of approximately 426 ac (172 ha) on nine separate active and inactive biosolids land application sites on the ORR (SAIC, 1996). Six of the sites are actively used in DOE biosolids land application and cover a combined 329 ac (133 ha). The three remaining sites, which cover 52 acres, were used for biosolids application in the past, and are currently inactive. These inactive sites may be used again in the future.

The purpose of the survey was to determine the presence or absence of wetlands at any of the active or inactive biosolids application sites, and to mark wetlands in the field so that biosolids applicators would not inadvertently disperse biosolids into a wetland. The approximate boundaries of each wetland area were marked with surveyors ribbon.

Thirteen wetlands were identified at seven of the biosolids land application sites. All wetlands are of human origin and are associated with old farm ponds at the sites. Twelve of these wetlands are on active sites and one is on an inactive site (McCoy). Discussions with scientists associated with the biosolids land appliers indicated the applicators were already aware of the existence of these ponds. It is a general policy of the biosolids application program to maintain a wide buffer zone (i.e., 500 ft) around these ponds and to avoid these sites when applying biosolids.

**Table 3.1. ORR Biosolids Land Application Site Designated Wetlands**

<b>Application Site</b>	<b>Wetland Type</b>	<b>Wetland Size (acres)</b>
Rogers	Pond	0.9
High Pasture	Pond	0.3
Scarboro	Pond	0.4
	Pond	0.2
	Pond	0.07
	Pond	0.07
	Pond	0.1
	Pond	0.7
Watson Road	None	-
Upper Hayfield #1	Pond	0.7
	Pond	0.3
Upper Hayfield #2	Pond	0.05
	Pond	0.7



### 3.7 CLIMATE AND AIR QUALITY

The Oak Ridge area has a temperate, continental climate. Summers are warm and humid; winters are typically cool. Spring and fall are transitional seasons, normally warm and sunny. Severe weather (e.g., tornadoes or high winds, severe thunderstorms with damaging lightning, extreme temperatures, or heavy precipitation) is rare. Average annual precipitation is ~140 cm (55 in.). The Oak Ridge area has one of the lowest average wind speeds in the United States. Local terrain is the dominant influence on daily wind patterns and contributes to the low average wind speed. Prevailing wind directions are either southwesterly daytime winds or northeasterly nighttime winds. The Oak Ridge area is an attainment area (i.e., within permissible limits) with respect to National Ambient Air Quality Standards for all criteria pollutants (sulfur dioxide, particulate matter, nitrogen dioxide, carbon monoxide, ozone, and lead) (DOE 1996).

### 3.8 ECOLOGICAL RESOURCES

Terrestrial habitats on the ORR include hardwood forest, pine forest, mixed hardwood/pine forest, pine plantations, open grass/agricultural fields, and industrial areas. Approximately 70% of the ORR is in natural or planted forest. Because of their unique protected status by association with the ORR facilities, several areas of these habitats and associated wildlife have received limited human disturbance since 1942. The ORR was designated as a unit of the Southern Appalachian Biosphere Reserve within the United Nations' Man and the Biosphere Program. The ORR has also been established as a Wildlife Management Area under a cooperative agreement between DOE and the Tennessee Wildlife Resources Agency (TWRA) and includes the 20,000-acre Oak Ridge National Environmental Research Park and several state Natural Areas.

Wildlife on the ORR benefit not only from the quality of the habitats available but also from the interspersed (diversity) of the habitats. A diversity of habitats often makes it easier for an individual animal to provide for its needs in a given area of land. However, some species require large unbroken tracts of a single habitat. Many of the wildlife species, such as the white-tailed deer (*Odocoileus virginianus*), are ubiquitous and can be found in almost any habitat, although they may show a preference for a certain type. Other species, such as the yellow-breasted chat (*Icteria virens*), are to be found only in a specific type of habitat.

Game animals range from the gray squirrel (*Sciurus carolinensis*) to turkey (*Meleagris gallopavo*) and white-tailed deer. Public deer and turkey hunts on the ORR are managed by the TWRA. These are the only hunting activities allowed on the ORR.

Aquatic habitats on the ORR include small streams, Bear Creek, EFPC, the Clinch River, and several scattered ponds. Several species of fish, reptiles, and amphibians are found in these areas. Muskrat (*Ondatra zibethica*) and beaver (*Castor canadensis*) are found close to aquatic areas. The muskrat prefers open terrain where aquatic vegetation and dense growths of riparian grasses, sedges, and rushes exist, and beavers are found in locations where there are trees for food and for building dams and lodges. Mink (*Mustela vison*) and raccoon (*Procyon lotor*) are found in aquatic habitats but range into forest and field areas. Large mammals visit aquatic areas to drink.

Ecological studies and monitoring of EFPC have shown population trends and distributions similar to those found in Bear Creek. Densities of fish populations and benthic communities are lower and not as diverse as they should be in a stream of this size. Species richness, diversity, density, biomass, and production are lowest immediately below Y-12, and generally increase with distance downstream. Monitoring is showing that recovery is occurring in the lower reaches of EFPC and should continue (DOE 1996). Detailed information on the aquatic habitats of these two creeks can be found in the *East Fork Poplar Creek-Sewer Line Beltway Remedial Investigation Report* (DOE 1994a).

Five of six of the ORR Biosolids Land Application Sites are open grassland areas devoid of caves, streams and large bodies of water. The remaining application site is a mature forested area. Boundaries of the application sites are dominated by mature hardwood tree species that provide suitable habitat for a wide variety of plant and animal species. Four of the six application sites (Upper Hayfield 1 and 2, Scarboro Road and High Pasture) do not provide habitat for listed plant species. Watson Road and Roger's site have the possibility to provide listed plant habitat for shade tolerant species.

### **3.8.1 Threatened and Endangered Species**

A Threatened and Endangered Species Survey was conducted by TN & Associates, Inc., of the biosolids application areas on the ORR in the spring and summer of 1997 (TN & Associates, 1997). The objective of the study was to survey six active and one inactive biosolids application sites in search of federally and state-listed threatened and endangered plant species and vertebrate habitat.

The plant and animal surveys were conducted by grouping the listed species known to occur on the ORR (or for which there is habitat) according to their environmental requirements (e.g., water and light availability). Potential listed habitat on the biosolids application sites was categorized according to physical gradients, the resulting intersection of potential habitat and protected species guided the surveys. Plant species were actively searched in the early spring and late summer growing seasons. The most recent survey of protected terrestrial vertebrates on the ORR (Mitchell et al. 1996) was used as the primary reference for vertebrate habitat identification. In addition a current species sightings list for Anderson and Roane counties was also obtained from TDEC, Division of Natural Heritage. The listed species survey did not include any active trapping or mist netting for vertebrates.

### **Plants**

Four of the sites (High Pasture, Upper Hayfield # 1 and # 2, and Scarboro) are hayfields that are mowed each fall. These fields do not provide potential habitat for listed plant species. One site, Rogers, is planted with a diverse array of shrubs, trees and grasses which provide abundant wildlife food and habitat, but do not contain known listed habitats. Rocky limestone bluffs were encountered adjacent to application site boundaries at Rogers. These sites were surveyed for listed species, but none were sighted. About half of the Watson Road site is a dead pine plantation undergoing secondary succession. The remainder of the site also contains a natural forest and a riparian zone which do provide potential listed habitat. These areas were surveyed throughout the growing season for listed species, but none were identified.

Several sites adjacent to application areas are noteworthy because they are relatively undisturbed and/or are not commonly encountered on ORR:

- the mature upland hardwood stand at Watson Road,
- the mature forest on the west side of Upper Hayfield #1, and
- the west facing slope on Scarboro Road site.

However, these areas are outside of the application site boundaries.

## Vertebrates

The ORR Biosolids Land Application Sites provide suitable habitat for 11 species of listed vertebrate animals listed in **Table 3.2**.

**Table 3.2 ORR Biosolids Land Application Sites Vertebrate Listed Species**

Common Name	Scientific Name	Federal or State Status
<i>Mammals</i>		
Gray bat	<i>Myotis grisescens</i>	Federal Endangered
Indiana bat	<i>Myotis sodalis</i>	Federal Endangered
Eastern wood rat	<i>Neotoma floridana</i>	State In Need of Management
Meadow jumping mouse	<i>Zapus hudsonius</i>	State In Need of Management
<i>Reptiles</i>		
Eastern slender glass lizard	<i>Ophisaurus attenuatus</i> <i>longicaudus</i>	State In Need of Management
<i>Birds</i>		
Northern harrier	<i>Circus cyaneus</i>	State In Need of Management
Vesper sparrow	<i>Pooecetes gramineus</i>	State In Need of Management
Yellow-bellied sapsucker	<i>Sphyrapicus varius</i>	State In Need of Management
Common barn owl	<i>Tyto alba</i>	State In Need of Management
Bachman's sparrow	<i>Aimophila aestivalis</i>	Possible Federal Listing
Bewick's wren	<i>Thryomanes bewickii</i>	Possible Federal Listing

Aquatic species were not considered in this EA because federal regulations prohibit application of biosolids in areas or under conditions that would allow the material to enter a wetland or other waters of the United States.

The ORR Biosolids Land Application Sites provide suitable habitat for state and federally listed vertebrate species, including four species of mammals (Gray bat - *Myotis grisescens*, Indiana bat - *Myotis sodalis*, Eastern wood rat - *Neotoma floridana* and Meadow jumping mouse - *Zapus hudsonius*), one reptile species (Eastern slender glass lizard - *Ophisaurus attenuatus longicaudus*) and six bird species (Northern harrier - *Circus cyaneus*, Vesper sparrow - *Pooecetes gramineus*, Yellow-bellied sapsucker - *Sphyrapicus varius*, Common barn owl - *Tyto alba*, Bachman's sparrow - *Aimophila aestivalis* and Bewick's wren - *Thryomanes bewickii*). Most of these species would be likely to use these areas as habitats as a result of the clearing or open field nature of the sites. Thus, maintaining the sites as hayfields with biosolids applications would favor the potential use of the application sites by these species. None of these species consume earthworms as a high proportion of their diet, thus further minimizing any potential for heavy metal or radionuclide exposure.

Of the mammal species, the federally-listed endangered Gray and Indiana bats could potentially occur on or near the application sites. The Gray bat would be favored by the number of caves in the vicinity of the Clinch River. Gray bat caves have also been commonly found in areas with a mixture of forest and fields. The Indiana bat nests in specific caves and mining locations in Kentucky and Missouri; however, the ORR Biosolids Sites could provide suitable foraging habitat. The Indiana bat prefers foraging near streams and rests under the bark of exfoliating (loose) or dead trees. Thus, although there are no caves actually within the application areas, these sites could offer potentially suitable foraging habitat for both bat species. The state-listed Meadow jumping mouse could occur in any of the open grassy areas present at all the application sites except Watson road, however, it would be most likely to be found in the vicinity of the ponds that occur at several of the sites. The state-listed Eastern wood rat could occur in the wooded rock outcrop areas that appear at the Rogers, Upper Hayfield #2 and Scarboro Road sites.

The application sites offer a potentially suitable habitat for only one reptile or amphibian species, the state-listed Eastern slender glass lizard. This species prefers cutover woodlands and grassy fields.

The application sites offer potentially suitable habitats to six state-listed bird species: the Yellow-bellied sapsucker, Northern harrier, Vesper sparrow, Common barn owl, Bachman's sparrow, and Bewick's wren. All of these species require either a combination of forest and clearings or open, weedy fields or grasslands. Most of the Vesper sparrows sighted in Tennessee have been transients and not nesting birds. The species that potentially would be most affected by the biosolids application program are the Grasshopper sparrow and Bachman's sparrow.

These sparrows make their nests out of plant fibers and grasses placed on the ground. The breeding season for both species is from May to July. Mitchell *et al.* (1996) reported a population of grasshopper sparrow in hayfields in the Freels Bend area of the ORR near the Clinch River. The Freels Bend area is near the ORR applications sites located along Scarboro Road and Bethel Valley Road, and there is definite potential that this species could be nesting in the application sites.